

Research Highlight

Despite their widely recognized importance, aerosol indirect effects are still full of uncertainty, even controversy for some aspects. One reason for the uncertainty/controversy is that aerosol effects are often intertwined with changes in cloud dynamics such as vertical velocity, and separation of aerosol indirect effects from dynamical effects poses a confounding challenge, especially in observations. Department of Energy scientists at Brookhaven National Laboratory and collaborators have taken on the issue using data collected in cumulus clouds during the Routine AAF [Atmospheric Radiation Measurement (ARM) Aerial Facility] Clouds with Low Optical Water Depths (CLOWD) Optical Radiative Observations (RACORO) field campaign, with a focus on the effect of vertical velocity on cloud droplet number concentration and relative dispersion, two cloud microphysical properties critical for quantifying aerosol indirect effects.

This observational study confirms their early theoretical prediction that variation of vertical velocity leads to a negative correlation between cloud droplet number concentration and relative dispersion: an increase in vertical velocity leads to an increase in cloud droplet number concentration but a decrease in relative dispersion, opposite to that caused by changes in aerosol loading.

The study demonstrates that one can capitalize on the opposing effects of aerosol loading and vertical velocity on relative dispersion to help discern their relative importance.

Reference(s)

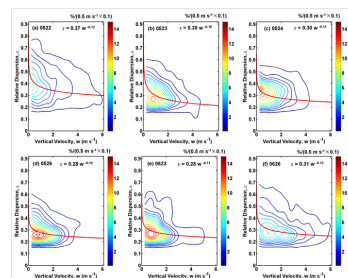
Lu C, Y Liu, S Niu, and AM Vogelmann. 2012. "Observed impacts of vertical velocity on cloud microphysics and implications for aerosol indirect effects." *Geophysical Research Letters*, 39, L21808, doi:10.1029/2012GL053599.

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Working Group(s)

Cloud Life Cycle, Cloud-Aerosol-Precipitation Interactions



Joint probability density functions (PDF) of relative dispersion (#) versus vertical velocity (w) along horizontal aircraft legs for each cumulus flight (date given in legend). The red lines denote weighted least squares power-law fits of the data.